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A STRAIGHTFORWARD MEMORY FUNCTION CALCULATION WITH THE NON-EQUILIBRIUM STATISTICAL OPERATOR METHOD

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A straightforward function calculation in the non-equilibrium statistical operator (NSO) method is suggested. As an example the relaxation of a two-level system to a thermostat is considered.

1. Introduction

The efficiency of the non-equilibrium statistical operator (NSO) method (Zubarev's method) in the theory of non-equilibrium processes (see, for example, book [1] or review [2]) is well known. As is known from ref. [2] the NSO method expresses the ideas of a reduced description in the most compact form in comparison with the projection operators method or with the method of quasi-equilibrium distribution construction. The kinetic equations obtained by means of the NSO method (see, for example, eq. (3.97) in ref. [2]) have a non-Markovian character, i.e. they have a memory. But in most physical problems connected with relaxation or kinetics (for example, in magnetic relaxation problems) this memory has not been taken into account. The reasons of this neglect lie in the difficulties of the memory function calculation (in other words, of an integral kernel of the kinetic equation) or in the physical peculiarities of the behavior of the system under consideration. For an illustration of the latter we consider now a spin system of a paramagnetic crystal.

A spin system in a magnetic field has two characteristic time scales T_1 and T_2: T_1 is the spin–lattice relaxation time, T_2 is the spin–spin relaxation time. In problems of magnetic resonance usually $T_1 \gg T_2$ and the kinetics of the spin system can be considered as a Markovian process. However, a situation is possible when $T_1 > T_2$ but in which the time T_1 is not so long that memory effects could be excepted from consideration. But in this situation memory